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From Classroom to Microlearning: Comparing Learner Perceptions of Traditional and Innovative Approaches in Lifelong and Adult Education in Tanzania

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ABSTRACT

Access to quality adult education remains a significant challenge in many developing countries due to low technology adoption, inadequate teaching materials, and adult family responsibilities. Traditional educational models often fail to address the diverse needs of learners, highlighting the need to adopt innovative approaches. This study examined challenges of traditional classroom learning, compared learners' perceptions of its effectiveness to blended and microlearning, and assessed differences in perceived effectiveness among the approaches. Using quantitative survey design combining both descriptive and analytic components, a total of 227 graduate and ongoing adult learners were studied. Data were analyzed using means, frequencies, thematic analysis, the Relative Importance Index (RII), and one-way ANOVA. Time constraints and lack of flexibility (RII= 0.86) was the most significant challenge of traditional face-to-face learning. Mean scores indicated that blended learning and microlearning were perceived as more effective than traditional learning. Furthermore, ANOVA results demonstrated that blended learning and microlearning were associated with significantly higher effectiveness scores compared to traditional face-to-face learning. Based on the findings, this study offers practical insights in improving accessibility, engagement, and learning effectiveness among adult learners.

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1. Introduction

Human learning has always been a constant endeavor from birth to death, suggesting that learning is an integral part of human life. In educational circles, lifelong learning emphasizes the desire for and continuity of human education. Consequently, both young people and adults need to continue learning throughout their lives. For decades, adult education has traditionally been conducted using face-to-face approaches, where learners and instructors meet in person. This mode of learning offers several advantages, including physical and emotional connections between the learner and instructor, enhanced concentration, and immediate dialogue (Naznean, 2022; Topping, 2023).

However, adult learners often face numerous social, economic, cultural, and personal obligations, making it difficult to engage in traditional learning settings (Mahai, 2021). In Tanzania, rigid attendance schedules and conventional teaching methods frequently cause adult learners to feel as though they are part of formal schooling systems rather than flexible adult learning environments (Emmanuel, 2018). This challenge has prompted the introduction of various

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online-based programs, such as online learning, open distance education, microlearning, and blended learning, which utilize the internet as the primary learning platform instead of the classroom. Despite the adoption of internet-based learning approaches like Open Distance Learning (ODL), many adult learners continue to struggle to access higher education. For instance, studies in Tanzania indicate that students face difficulties attending face-to-face sessions (Mariki, 2025), lack sufficient study time, encounter financial constraints, and manage work–family responsibilities that affect their participation in learning activities (Mwila, 2025). Consequently, time constraints and scheduling challenges remain major concerns in Tanzanian adult education.

Blended learning and microlearning have increasingly been recognized as effective, innovative approaches that can improve access for adult learners. However, a comparative analysis of their effectiveness has not yet been conducted (Kapinga & Mtani, 2014; Ghasia & Rutatola, 2021; Almasi, Machumu & Kalimasi, 2025). These approaches offer flexibility in terms of time, space, and pace. Additionally, existing studies in Tanzania have primarily focused on barriers to the implementation of open and distance learning (ODL) or blended learning, rather than directly comparing the effectiveness of traditional face-to-face learning, blended learning, and microlearning among adult learners (Kapinga & Mtani, 2014; Mariki, 2025). Due to limited empirical evidence in Tanzania comparing these approaches within adult education contexts, this study investigates how blended learning and microlearning can be leveraged to enhance lifelong learning among adult learners. By comparing these methods, the study aims to provide evidence that may guide institutions and policymakers in designing more responsive adult education programs tailored to the Tanzanian context.

In this study, lifelong learning is viewed as an educational phenomenon encompassing all life processes from birth to death and activities aimed at developing individuals' knowledge, skills, and competencies (Kaplan, 2016). Meanwhile, adult education is conceptualized within the framework of five segments, referred to as the AE typology (Rubenson & Elfert, 2013). These five segments include the foundational segment, higher education segment, workplace-related segment, other labor market-related segment, and the personal/social segment. However, this study focuses specifically on the higher education segment.

Blended learning is an educational approach that combines face-to-face instruction with online learning (Almasi, 2019). Traditionally, most formal adult learning programs in Tanzania have relied on face-to-face teaching. This method limits adult learners' access, tends to be costly and time-consuming, and requires the physical presence of the learner, which can be challenging due to adult responsibilities. Therefore, there is a need to adopt innovative approaches, particularly blended learning and microlearning, which offer advantages that are often unattainable in traditional settings. Unlike conventional classroom learning, which is typically fixed in time and place, blended learning and microlearning provide more flexible, learner-centered opportunities that can support lifelong learning among adults (Nkkhoo, 2023; Alias & Razak, 2025).

Microlearning involves delivering content in small, focused segments, such as short videos, quizzes, and infographics, which can be quickly consumed, often via mobile devices (Ghasia & Machumu, 2021). It emphasizes short-term, informal learning activities or on-the-job learning when learners need knowledge to solve specific problems (Drakidou, 2018). Microlearning is valuable because it enhances access, engagement, and flexibility, particularly for adult learners. When combined with blended learning, which encompasses both formal and informal learning, microlearning becomes a powerful approach to adult lifelong learning. The next section of this paper outlines key barriers to adult learning in Tanzania from the perspectives of microlearning and blended learning. It then discusses how these approaches can be leveraged to improve adult and lifelong learning in Tanzania.

2. Literature Review

2.1 Key Challenges to Adult Learning in Tanzania: Traditional Approaches vs Blended and Microlearning

Numerous studies have examined the challenges facing adult education in Tanzania. This section summarizes these challenges, with a particular emphasis on those related to instructional methods. For instance, a study by Msuya

(2016) identified insufficient teaching and learning resources, including inadequate library space, as significant obstacles. In response, the present study proposes that introducing blended and microlearning approaches could help mitigate these issues. These methods leverage online resources that learners can access anytime and anywhere, provided they have internet connectivity.

Interestingly, a study by Mwakyambiki et al. (2024) identifies five key challenges to adult education, including the availability of qualified teachers, domestic responsibilities, time constraints, and a lack of conducive learning environments. However, challenges such as time limitations and domestic roles could be mitigated by introducing blended and microlearning approaches, enabling learners to study conveniently at home or in the workplace. Similarly, Cosmas (2018) reports that adult learners often struggle to balance their study time with other commitments. Further research shows that some adult learners lack skills related to internet and computer use (Cosmas, 2018), which may pose challenges when learning through blended and microlearning approaches, as these methods largely rely on internet access. Nevertheless, this study asserts that the lack of advanced computer skills may not necessarily be a hindrance, since blended and microlearning require only basic skills that can be easily acquired. For instance, in the study by Almasi, Zhu, and Machumu (2018), students with basic computer skills performed better than those with advanced skills.

2.2 Enhancing Adult Learning Through Blended Learning and Microlearning Approaches

Blended learning is often regarded as a new phenomenon, but it is rooted in an established concept. However, this perspective depends on how it is defined. Blended learning involves the integration of traditional classroom-based instruction with online or internet-based teaching methods (Almasi, 2019). It is a hybrid educational approach that combines the strengths of both traditional and online instructional methods. As a pedagogical strategy, blended learning is typically characterized by a combination of classroom and online activities that integrate face-to-face interaction with digital tools and online content delivery (Zhang, Huang, & Ma, 2008; Almasi et al., 2024). It offers flexibility in time and location, allowing learners to access materials anytime and anywhere (Hrastinski, 2019). Furthermore, blended learning enhances student engagement, provides diverse learning resources, fosters opportunities for collaboration and communication, supports lifelong learning, and facilitates continuous learning and feedback (Graham, 2006; Garrison & Vaughan, 2008; McLaughlin et al., 2014; Thamrin et al., 2024; Almasi et al., 2024; Almasi et al., 2025).

However, the cited benefits of blended learning are not achieved automatically. Instructors must rethink and redesign their courses to realize these advantages. This assertion is supported by studies conducted by Hoic-Bozic, Mornar, and Boticki (2008); Vaughan (2010); Jeffrey, Milne, and Suddaby (2014); Yin and Yuan (2024); and ElSayad (2024). One effective approach to redesigning blended learning courses is through the Community of Inquiry framework (Vaughan, 2010). The Community of Inquiry is a critical discourse model comprising three interactive elements: teaching presence, cognitive presence, and social presence. A blended course designed with these elements tends to foster collaboration and enhance both the sense of community and learning (Almasi et al., 2024).

On the other hand, microlearning utilizes short, targeted content that is primarily delivered online or with internet support (Alias & Razak, 2025). This teaching and learning approach rely on well-focused, bite-sized, and easily digestible content that can be completed in the shortest possible time (Ghasia and Rutatola, 2021; Ghasia, 2023). The concept of microlearning is based on Hermann Ebbinghaus's forgetting curve, which states that when people absorb large amounts of information, retention declines over time (Nikkhoo et al., 2023). According to Ghasia (2023), microlearning is characterized by several key features: small-sized content, often described as material that is digestible and easily grasped within a brief period to accommodate modern learners; and a focus on a single learning objective. Other attributes of microlearning include independent units, even when part of a larger whole; highly interactive content and activities; multi-device compatibility; and content available in diverse formats such as text, video, and audio. Consequently, online materials—including video tutorials, audio podcasts, presentations, scenarios, and assessments—can be effectively presented as microlearning.

Nevertheless, microlearning has been criticized for being unsuitable for complex materials and the development of analytical skills, as its use of small content chunks may hinder learners from gaining an in-depth understanding of the

subject matter (Fitria, 2022; Nikkhoo et al., 2023). Additionally, its effectiveness depends on individual learner characteristics, suggesting it may only be appropriate for certain types of learners (Sozmen, 2022). However, microlearning can serve as an integral component of blended learning, where instructors design courses that incorporate key features of the microlearning approach (Nkou, 2019; Semingson, Crosslin, & Dellinger, 2015). This suggests that blended learning can effectively integrate microlearning elements to enhance student learning.

Therefore, this study posits that both blended and microlearning approaches can serve as innovative and effective methods to enhance lifelong and adult education in Tanzania. Several studies have confirmed the practical benefits of these approaches (Yu et al., 2025; Almasi et al., 2024; Lusa, Adanan, & Yurniawati, 2022; Almasi & Zhu, 2020; Vo, Zhu, & Diep, 2017), including their positive impact on student learning, motivation, and satisfaction. Furthermore, microlearning has been shown to improve retention, reduce cognitive overload, and enhance student learning outcomes (Zarshenas, 2022; Senadheera et al., 2023).

2.3 Theoretical framework

This study employs Self-Determination Theory (SDT) and the Community of Inquiry (CoI) framework (Garrison & Arbaugh, 2007; Ryan & Deci, 2024). SDT posits that individuals are most motivated and engaged in learning when their basic psychological needs—autonomy, competence, and relatedness—are satisfied (Ryan & Deci, 2024). This suggests that adult learners need to feel autonomous to sustain their learning; they also need to perceive that they are acquiring competence throughout the learning process while maintaining connections with other learners and their workplaces (Nikou, 2019). Traditional learning is characterized by physical presence and a controlled curriculum, requiring the actual attendance of the adult learner. This approach may impact the adult learner's sense of autonomy and relatedness, especially with close family members. According to SDT, such learners may feel disconnected from their families because they must spend significant time in educational settings while also managing work responsibilities. In contrast, blended and microlearning approaches offer flexibility in terms of time, space, pace, and ownership of learning. Therefore, these approaches may serve as better alternatives, allowing adult learners to study conveniently at home or in the workplace, thereby maintaining relationships with close family members and fostering a greater sense of autonomy.

Meanwhile, the Community of Inquiry (CoI) framework is grounded in Dewey's (1959) conception of education as a communal enterprise, where the educational experience integrates the interests of both the individual and society. Accordingly, adult learning must address the needs of the adult learner as well as those of their family and community. Adult learners should be able to engage in learning while simultaneously fulfilling other societal responsibilities, including work and family life. Additionally, the Community of Inquiry (CoI) framework posits that learning occurs through collaboration between students and instructors. It suggests that courses be designed to foster teaching, social, and cognitive presences (Garrison & Arbaugh, 2007). The term "presence" refers to an adult learner's sense of belonging and engagement in blended, microlearning, or traditional courses (Almasi, 2019). Teaching presence encompasses course design and administration, facilitation of discourse, and direct instruction (Almasi, 2019). Social presence is defined as the ability of learners to project themselves socially and affectively within a community of inquiry (Anderson et al., 2001). Within the CoI framework, social presence is demonstrated through adult learners' participation, interaction, and collaboration in the course.
Cognitive presence encompasses the exchange of information, the connection of ideas, and their application, enabling learners to progress from lower-level meaning construction to higher-order thinking (Almasi, 2019).

These presences are essential for sustaining learning and creating meaningful educational experiences. Consequently, this study proposes that autonomous, competent, and connected learners who engage in well-designed blended and microlearning courses will continue lifelong learning, as such learning aligns with their goals. Presumably, blended learning courses are structured to reflect the teaching, social, and cognitive presences, which in turn influence the educational experiences of adult learners. Based on this premise, adult learners will sustain their learning more effectively when studying in blended and microlearning courses than when studying through traditional face-to-face methods. Figure 1 illustrates the link between the SDT variables and the CoI framework's teaching, social, and cognitive presences in the context of traditional, blended, and microlearning modalities in adult education.

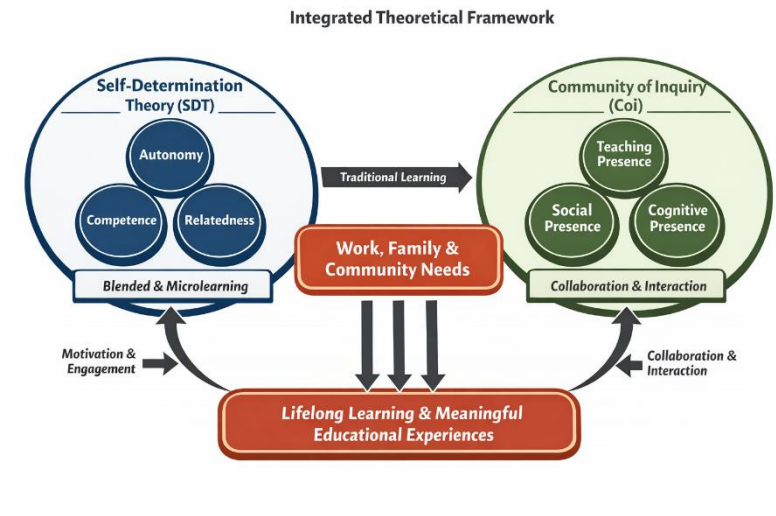

Figure 1: Integrated theoretical framework showing the link between SDT and CoI

3. Purpose

This study investigates how adult learners perceive blended learning, and microlearning in relation to the effectiveness of these learning approaches. The study was guided by the following specific objectives.

1. To identify the common challenges associated with traditional classroom learning as experienced by adult learners.
2. To examine learners' perceptions of the effectiveness of traditional, blended, and microlearning instructional methods and determine whether significant differences exist in their perceived effectiveness.

4. Method

This study investigates adult learners' perceptions of blended learning and microlearning, focusing on the effectiveness of these learning approaches. The study employed a quantitative survey research design with descriptive and analytical (comparative) components (Gürbüz, 2017). The descriptive component aimed to identify and summarize students' study skills, while the analytical component examined differences across groups using one-way ANOVA. Participants included continuing students and graduate adult education learners from various study programs.

The sampling frame comprised 227 continuing and graduate adult education learners from various universities in Tanzania. Participants were recruited using an online Google Forms questionnaire distributed through convenience and voluntary participation methods. Convenience sampling was employed to select participants based on accessibility and willingness to participate (Creswell & Creswell, 2018). Specifically, the researcher contacted potential participants via various platforms, including class groups, peer networks, and academic contacts, inviting them to take part in the study. Additionally, voluntary response sampling was used when individuals self-selected after receiving invitations through platforms such as WhatsApp and Facebook. Participation was voluntary, and students who met the inclusion criteria—being continuing university students or recent graduates between 2023 and 2025—were invited to complete the questionnaire.

The use of online Google Forms to reach participants enabled the researcher to access a large number of individuals who might otherwise have been unreachable. This method also facilitated rapid participant recruitment and

supported data collection from geographically dispersed respondents. However, this approach tends to limit the generalizability of the findings, as the sample may not represent the broader population. Additionally, such sampling only includes individuals with greater interest, motivation, or internet access, which can lead to selection bias (Bryman, 2003). Finally, the sample size of 227 participants was considered adequate for conducting descriptive and inferential statistical analyses, including one-way ANOVA, which requires sufficient group representation for meaningful comparisons. Participants' ages ranged from 20 to 47 years. Of these, 52% were adult learners currently enrolled in degree programs, 40% were graduates, 16% held diplomas, and 2% did not specify their education level. Among the sampled participants, 61% were male and 39% were female.

Prior to participating in the study, participants were provided with information regarding the study's purpose, confidentiality, voluntary participation, and their right to withdraw at any time. Participants gave informed consent before accessing the questionnaire. Ethical approval for the study was obtained from the relevant institutional authority.

A questionnaire was administered to collect demographic information, including gender, education level, and age, as well as participants' experiences with traditional face-to-face learning and their perceptions of the effectiveness of blended and microlearning approaches. Both quantitative and qualitative data were gathered. The questionnaire was distributed online via Google Forms. The primary items utilized a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The questionnaire consisted of three main sections: participants' experiences with traditional face-to-face learning, their views on blended learning, and their opinions on microlearning approaches. Quantitative data measured participants' experiences and perceptions of traditional, blended, and microlearning methods. Additionally, an open-ended question was included to collect qualitative data on participants' views regarding microlearning.

Prior to data collection, the instrument was reviewed to ensure content validity, focusing on clarity, relevance, and alignment with the study objectives and measured constructs. The development and refinement of the questionnaire items were guided by expert reviews and relevant literature on traditional, blended, and microlearning studies. The tool was initially piloted among students at a rural university in Morogoro. Minor modifications were made before the instrument was distributed to the broader respondent group. Regarding reliability, the blended learning items (5) demonstrated good internal consistency, with a Cronbach's alpha of 0.86; traditional learning items (6) showed good reliability, with a Cronbach's alpha of 0.81; and microlearning items exhibited acceptable reliability, with a Cronbach's alpha of 0.79. The overall Cronbach's alpha was 0.90, which is considered excellent.

Data analysis included frequencies, mean scores, the Relative Importance Index (RII), and one-way ANOVA.
Regarding the most significant challenges of traditional face-to-face learning and the benefits of microlearning, the Relative Importance Index was calculated using the following formula.

$$\mathrm{RII} = \frac{\sum \mathrm{W}}{\mathrm{A} \times \mathrm{N}}$$

Where W = weight assigned to each item (in this case, frequency of mention), A = highest possible weight (maximum frequency among the items), and N = total number of valid responses. The interpretation of the Relative Importance Index (RII) for each indicator is adopted from Sakhare and Chougule (2019) and Almasi, Rumulika, Hakimu, and Mbukwa (2024), classified as follows: High (H) [$0.8 < \mathrm{RII} \leq 1.0$], High-Medium (H-M) [$0.6 < \mathrm{RII} \leq 0.8$], Medium (M) [$0.4 < \mathrm{RII} \leq 0.6$], Medium-Low (M-L) [$0.2 < \mathrm{RII} \leq 0.4$], and Low (L) [$0.0 \leq \mathrm{RII} \leq 0.2$].

The Relative Importance Index (RII) was employed because it facilitates the identification of the most significant challenges among those identified. This analysis simplifies the interpretation of ordinal survey data and provides a clear basis for prioritising variables. Unlike simple mean scores, the RII enables comparative ranking across multiple items measured on the same response scale (Kometa, Olomolaiye, & Harris, 1994). To determine the perceived effectiveness of traditional, blended, and microlearning approaches, mean scores and frequencies were calculated. Finally, a one-way ANOVA was conducted to assess whether significant differences exist in the perceived

effectiveness of the three approaches. This method was selected due to its ability to provide simultaneous comparisons across multiple study groups.

5. Results

5.1. Challenges Associated with Traditional Face-to-Face Classroom Learning

In the first objective, the study examined the most significant challenges reported by participants when learning in a traditional face-to-face system. Participants were asked to respond to closed-ended questions using a Likert scale ranging from 1 to 5, and then provide responses to an open-ended question regarding the challenges. Consequently, the Relative Importance Index (RII) was computed based on the responses provided. The most significant reported challenges were time constraints and lack of flexibility, with an RII of 0.86. However, resource and infrastructure limitations (RII = 0.40), learning and teaching effectiveness (RII = 0.39), and overcrowded learning environments (RII = 0.34) were reported as having medium scores. Lastly, psychological and social barriers (RII = 0.26) were reported as having a low score based on the RII analysis. Consequently, lack of flexibility in learning schedules and time constraints emerged as the key challenges affecting adult learners in the visited institutions. This indicates that the majority of participants perceived balancing academic responsibilities with work, family obligations, and other social commitments as a major challenge. The findings imply that adult learners often struggle to manage competing responsibilities while pursuing education.

The second most frequently reported challenge was resource and infrastructure limitations (RII = 0.40). This suggests that inadequate learning facilities, limited access to digital technologies, unstable internet connectivity, insufficient learning materials, and infrastructural challenges continue to affect the learning experiences of adult students. The presence of overcrowded classes and lack of teaching effectiveness were also reported as moderate challenges, suggesting the need to improve the nature of teaching and the classroom environment.

Table 1. Challenges of Traditional face-to-face learning and their Relative Importance Index

Rank	Challenge	Relative Importance Index
1	Time and Flexibility Issues	0.860
2	Resource and Infrastructure Limitations	0.400
3	Learning and Teaching Effectiveness	0.393
4	Overcrowding Environment	0.340
5	Psychological and Social Barriers	0.260

Moreover, the participants were asked to list two important challenges of traditional face-to-face learning. Based on the qualitative responses provided, the challenges of traditional learning can be broadly categorised into three major themes: flexibility and time management, learning environment and resources, and learning effectiveness and engagement. These findings support the quantitative findings reported earlier.

In terms of flexibility and time management, the rigid nature of traditional learning schedules and the difficulties individuals face in managing their time alongside other responsibilities were the most frequently reported challenges. Lack of flexibility in time and scheduling made it difficult for learners to balance academic and social responsibilities simultaneously. Regarding learning environment and resources, challenges related to the physical and logistical aspects of the learning environment, including infrastructure, class sizes, and availability of materials were listed. Participants reported issues of overcrowded classroom, difficulties in traveling to venues, inadequate learning resources and unconducive learning environment as key challenges. All these challenges point to the need for improvement of the classroom ecology and overall infrastructure of the studied universities.

Furthermore, difficulty in understanding content, lack of engagement due to passive learning or limited classroom interaction, lack of personalised learning, and fear of participating in class sessions were listed as the most important challenges under the third theme related to learning effectiveness and engagement. This suggests that traditional face-to-face learning delivery has an impact on learners' confidence and participation, as it affects their engagement in learning.

5.2. Learners' Perceived Effectiveness of Blended, Microlearning and Traditional Face-to-Face Learning

In the second objective, the study aimed to determine whether blended learning and microlearning were perceived as more effective than traditional learning. To achieve this, participants were asked to respond to several questions for each learning modality using a five-point Likert scale ranging from 1 to 5, where 1 represented *Strongly Disagree* and 5 represented *Strongly Agree*.

Traditional learning included a total of six questions as follows: *I can regularly attend face-to-face classes without difficulty; travel time or distance makes it hard for me to attend in-person classes; I am actively engaged during traditional classroom lessons; traditional classes fit well with my personal/work schedule; I understand lessons better when taught in person;* and *large class sizes make it hard to learn effectively*. The mean score obtained for traditional face-to-face learning was 3.32 (SD = 0.69).

Blended learning had five questions, which included: *Blended learning makes education more accessible to me; I can learn better when online and in-person methods are combined; blended learning helps me stay more engaged with the content; I can manage my time better when learning in a blended format;* and *I find it easier to review learning materials in blended learning environments*. The mean score for blended learning was 3.98 (SD = 0.71).

Finally, microlearning was assessed using the following questions: *Short learning sessions help me understand better than long sessions; I can remember more from short and focused lessons; microlearning fits well with my busy schedule; I feel more motivated when learning with short, engaging content;* and *I find mobile microlearning tools easy and enjoyable to use*. The mean score for microlearning effectiveness was 4.12 (SD = 0.67).

Overall, the microlearning modality was perceived the most effective (M = 4.12), followed by blended learning (M = 3.98), while traditional face-to-face learning was regarded as the least effective mode (M = 3.32). This suggests that participants perceive microlearning as more effective compared to blended learning and traditional face-to-face instructional methods.

Furthermore, in determining whether significant differences exist in perceived effectiveness of learning modalities (Traditional Face-to-face, Blended, Microlearning), one-way analysis of variance (ANOVA) was conducted to obtain effectiveness scores. The results show statistically significant effect of learning modalities on effectiveness scores, $F(2,678) = 47.91$, $p < .001$, $\eta^2 = 0.22$. Based on the analysis, a partial η^2 of 0.22 represents a large effect size, based on Cohen's (1988) guidelines. This indicates that 22% of the variance in perceived effectiveness scores can be attributed to the type of learning modality alone. This suggests a practically meaningful difference beyond mere statistical significance which is further explained in the discussion section.

Post-hoc comparisons using Tukey's HSD test were performed to determine which specific group means differed significantly. A significant difference was observed between blended learning (M = 3.98, SD = 0.72) and traditional face-to-face learning (M = 3.32, SD = 0.69), with blended learning showing significantly higher scores ($p < .001$). A significant difference was also found between microlearning effectiveness (M = 4.12, SD = 0.67) and face-to-face learning (M = 3.32, SD = 0.69), with microlearning showing significantly higher scores ($p < .001$). In addition, a statistically significant difference was found between microlearning (M = 4.12, SD = 0.67) and blended learning (M = 3.98, SD = 0.72) ($p = .012$). Conclusively, both blended learning and microlearning were associated with significantly higher effectiveness scores compared to the traditional face-to-face learning approach. Further discussion on the implications of these findings is provided in the next section.

6.Discussion

In this section the findings of the study are discussed in the light of the previous studies and in view of the social determination theory and the community of inquiry framework. Empirical, theoretical and logical links between findings and concepts are drawn and explained.

6.1 Challenges Associated with Traditional Face-to-Face Learning Approach

This study objective examined the challenges associated with traditional face-to-face learning. A novel analysis based on the Relative Importance Index (RII) was conducted to rank the most important factors, unlike many previous studies that relied solely on qualitative analysis. Adult learners were asked to report the challenges they experienced, which were then quantified. Based on the findings, time constraints and lack of flexibility were identified as the main challenges associated with the traditional face-to-face classroom.

These findings are reflected based on the RII criteria adopted from Johnson and LeBreton, 2004; Almasi et al., (2024). From the findings, only time constraint and flexibility seem to be high, making it more significant than the rest, while learning and teaching effectiveness (outdated methods, low engagement), overcrowding environment, and psychological and social barriers (lack of confidence to participate in the lesson, language) seem to have Low scores. This suggests that participants struggle to remain focused in one place while attending traditional classroom sessions. These findings align with the overall notion that adult learners often lack sufficient time to spend in traditional classroom settings, as they must attend to both social (family) and work-related matters. Such learners also face difficulties in attending traditional classes, which require physical presence. The lack of flexibility in traditional face-to-face instruction makes it challenging for adult learners to study autonomously and flexibly. Blended and microlearning approaches may be useful in addressing this gap.

When viewed from SDT theory, which posits that people are most motivated and engaged in learning when their basic psychological needs are met (Ryan & Deci, 2024), such findings imply that adult learners find satisfaction when time constraints are solved. Therefore, this may suggest the need for a learning modality that considers the time of the learner. Supporting this, the study by McLaughlin (2014) confirms the support provided by self-determination theory. However, instructors tend to be reluctant to employ educational technologies to support blended learning; as such, this makes the blended approach not fully integrated in the learning of students (Rasheed, Kamsin, & Abdullah, 2020). Consequently, this calls for effective training for instructors to help them integrate innovative learning approaches.

6.2 *Learners' Perceived Effectiveness of Blended, Microlearning and Traditional Face-to-Face Learning*

After examining the challenges associated with the traditional face-to-face learning approach, the study further determined whether blended learning and microlearning were considered more effective than the traditional face-to-face learning.

Based on the mean scores, the findings indicated that micro learning approach was perceived as the most effective learning approach (M = 4.12), followed by blended learning (M = 3.98). In contrast, traditional face-to-face learning was regarded as the least effective learning approach having the lowest mean score (M = 3.32). On the one hand, this finding supports that adult learners often combine education with employment, family responsibilities, and other social obligation. This denies then time and flexibility when attending traditional face-to-face sessions. On the other hand, the findings that adult learners perceived both blended and microlearning to be more effective than the traditional face-to-face learning could be explained by the fact that innovative approaches afford them flexibility in terms of time and space. This happens because both blended and microlearning allow learners to study at their own time, own pace and from anywhere. Several studies have confirmed the overall instructional advantages of blended learning and microlearning approaches.

For instance, studies such as Mostrady (2025) and Sozmen and Bati (2023) report that students studied through microlearning gained higher self-confidence in learning. This was related to the nature of such learning itself which allows learners to engage in the learning process through different media and have more time to interact with the study materials (Ghasia & Rutatola, 2021). Additionally, microlearning presents learning content in small, focused, and manageable units that are easier to complete within limited time period. Therefore, shorter learning sessions may reduce cognitive overload and improve attention, retention, and engagement among adult learners as opposed to the traditional face-to-face learning (Taylor & Hung, 2022).

In case of blended learning, Almasi, Zhu and Machumu (2018) found positive associations among the CoI elements, i.e., teaching presence, cognitive presence and social presence. Also, blended learning allows interactions in both online and face-to-face sessions allowing more flexibility and accessibility. Students studying via blended approaches have a chance to meet and study online, engage and discuss through online forums and yet attend face-to-face sessions (Almasi, 2019). In other words, blended learning increases teaching, social and cognitive presences which in turn improve student learning outcomes (Almasi et al, 2024). This shows that blended environments support interaction and learning engagement. In a systematic analysis conducted by Vallée et al. (2020) , the authors reported that blended learning produced significantly better knowledge outcomes than traditional learning.

The effects of both microlearning and blended are related to the use of digital tools such as mobile apps and e-learning platforms which allow interactive learning. Nevertheless, the benefits of blended learning and microlearning are not automatic; they depend on well-designed blended courses. This is supported by Kaur (2013), who emphasizes the importance of keeping online offerings interactive rather than merely talking at participants. This perspective is consistent with the Community of Inquiry framework, which posits that effective blended courses incorporate three interactive presences, cognitive, social, and teaching presence (Martin et al., 2022; Kyei-Blankson, Ntuli, & Donnelly, 2019). As postulated in the CoI framework, students find blended courses more interactive compared to traditional face-to-face conventional courses since such courses offer the best of both worlds, face-to-face interactions and online collaborative features such as discussion forums. This means that blended courses create multiple channels for communication which happens during online sessions and during physical classroom contacts (Picciano, 2009; Means et al., 2013; Almasi, Zhu, & Machumu, 2018).

Additionally, regarding whether differences in perceived effectiveness of the three learning approaches exist, blended learning showed significantly higher scores ($p<.001$) compared to traditional face-to face learning approach. Also, microlearning showed significantly higher scores ($p<.001$) compared to blended learning. Categorically, both blended learning and microlearning were associated with significantly higher effectiveness scores compared to traditional face-to-face learning. Consistent with the large effect size observed ($\eta^2 = 0.22$), the superiority of microlearning over blended and traditional formats may be attributed to its alignment with adult learners' busy schedules. This is reflected in the open-ended responses where time saving and flexibility were the most frequently cited benefits. However, based on the overall findings, both, blended and microlearning approach have been perceived as more effective instructional approaches for adult learners compared to the traditional face-to-face approach.

Practically, adult learners benefit more if they study using learning approaches that allow them to have flexibility in terms of time and space. Various studies confirm these findings. For instance, Elhamuye (2024) found blended learning to be an effective instructional approach in ESL/EFL education; BL improves students' academic performance (Tong et al., 2022) and consistently demonstrates better effects on knowledge outcomes compared to traditional learning in health education (Vallée et al., 2020). Meanwhile, a study by Pitaloka (2025) in Indonesia showed that microlearning helped to improve comprehension, retention, and motivation compared to conventional lectures.

Moreover, a 2024 systematic review on the impact of microlearning on academic performance of students in higher education reports that microlearning showed a significant effect on students' learning outcomes (Senandheera et al., 2024). However, the current study is perhaps one of the few that has compared the three modalities—traditional, blended, and microlearning—in one study. This makes it difficult to provide comparisons with previous studies. Past studies usually examined one or two approaches at a time. As such, this study brings a unique contribution by evaluating both blended and microlearning approaches alongside traditional face-to-face learning. This advocates

for the need to combine both approaches to influence students' learning outcomes. Overall, the findings imply that universities and adult education institutions in Tanzania may need to shift from mainly traditional face-to-face approaches towards more flexible, technology-supported learning models.

Contrary to traditional applications of self-determination theory and the community of inquiry framework, the findings of this study propose that the effectiveness of microlearning and blended learning among adult learners is influenced by increased flexibility, which enhances learner engagement and participation. Additionally, both blended and microlearning could succeed because they optimize the social presence and cognitive presence required to satisfy the learner's need for connection, which in turn sustains long-term engagement.

7. Conclusion and Recommendations

This study identified important challenges associated with traditional classroom learning, examined learners' perceptions regarding the effectiveness of traditional learning versus blended and microlearning, and determined if there are significant differences in perceived effectiveness between traditional, blended, and microlearning approaches. A novel analysis, the Relative Importance Index, was used to rank the challenges.

Regarding challenges accrued from traditional face-to-face instruction, based on RII results, time constraint and lack of flexibility (RII = 0.86) were the most significant challenges of traditional face-to-face learning. Qualitative findings confirm these results. Based on mean scores, blended learning and microlearning were reported as most effective compared to traditional learning, respectively. This aligns with Self-Determination Theory (SDT), which posits that learners are most motivated when their autonomy is supported. Adult learners struggle to balance educational commitments with work and family responsibilities. Other challenges, such as infrastructure limitations, low teaching effectiveness, overcrowding, and psychological barriers, were found to be less significant but still impactful.

In terms of the effectiveness of instructional approaches, quantitative results showed that participants rated micro-learning as more effective than both blended learning and traditional face-to-face learning. Also, the results of ANOVA show that blended learning and microlearning were associated with significantly higher effectiveness scores compared to traditional Face-to-face learning. These findings align with literature suggesting that blended learning supports autonomy, engagement, and flexible access to educational content.

The study further reveals that microlearning and blended approaches are better at meeting adult learners' preferences for flexible, short, interactive, and personalized content. These modalities not only fit better with learners' schedules but also increase motivation and knowledge retention. However, the effectiveness of these methods depends on proper design, technological readiness, and instructor competence in integrating them.

Based on the findings, the study recommends the following: Adult learning institutions should increasingly integrate blended and microlearning approaches to accommodate learners' diverse schedules and responsibilities. Time and flexibility should be central design considerations in adult education programs.

Notably, effective implementation of blended and microlearning requires instructors to be trained in digital pedagogy and course design. Therefore, investment in reliable digital infrastructure, interactive learning platforms, and mobile learning tools is essential to support these modalities. When fully adopted, to maximize the benefits of blended and microlearning modalities, learning content should include interactive elements, frequent feedback, and opportunities for social and cognitive engagement, as highlighted in the Community of Inquiry (CoI) framework.

This study is limited in the following ways: The use of a small sample size, that is, 227 participants only may reflect the views of a small group, which may not represent all adult learners or educational contexts across regions. Meanwhile, while the study assessed perceived effectiveness, it did not evaluate the actual content design or implementation fidelity of blended or microlearning programs. Future studies should explore how different design strategies impact learning outcomes

Declarations

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Not available

Competing Interests
None.

Ethical Approval
This study was granted an exemption from requiring ethics approval as it does not involve human participants or the collection of sensitive personal data. The research is based on bibliometric methods, utilising secondary data exclusively from the Scopus database. As such, it adheres to institutional guidelines that classify this type of study as low-risk and not subject to formal ethics approval.

Author's Contribution
Author[1]: Conceptualization, Data curation, Formal analysis, Writing – original draft

References

Alias, N. F., & Razak, R. A. (2025). Revolutionizing learning in the digital age: A systematic literature review of microlearning strategies. Interactive Learning Environments, 33(1), 1-21.

Almasi, M., & Zhu, C. (2020). Investigating Students' Perceptions of Cognitive Presence in Relation to Learner Performance in Blended Learning Courses: A Mixed-Methods Approach. Electronic Journal of Learning, 18(4), 324-336. https://doi.org/10.34190/EJEL.20.18.4.005

Almasi, M. (2019). Investigating influential variables related to blended learning courses in the context of selected Tanzanian universities. PhD Dissertation. Vrije Universiteit Brussel, Brussels.

Almasi, M., Mgata, F. Y., Machumu, H., & Masashua, A. (2025). Students' experiences and motivational factors on using e-learning systems in higher education institutions in Tanzania. Educational Technology Quarterly, 2025(1), 86-100. http://dx.doi.org/10.55056/etq.866

Almasi, M., Zhu, C., Machumu, H., Rwechungura, E. M., & Fred, M. (2024). The influence of student interaction on sense of community and academic performance in blended learning courses in selected Tanzania universities. *The International Journal of Learning Spaces Studies*, *3*(3), 31-42.

Almasi, M., Machumu, H., & Kalimasi, P. Exploring Students' Perceptions of Moodle as a Tool for Enhancing Transformative Learning in a Rural University in Tanzania. https://doi.org/10.36261/ijdeel.v11i1

Almasi, M., Rumulika, S. M., Hakimu, J., & Mbukwa, J. N. (2024). Teachers'beliefs and constraints in adopting learner-centered pedagogy; an analysis of teacher-centered methods in tanzanian teacher training colleges. Pedagogik: Jurnal Pendidikan, 11(2), 249-263.

Almasi, M., Zhu, C., & Machumu, H. (2018). Teaching, social, and cognitive presences and their relations to students' characteristics and academic performance in blended learning courses in a Tanzanian University. Afrika Focus, 31(1), 73-89.

Anderson, T., Rourke, L., Vaughan, R. D., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. JALN 5(2).

Bryman, A. (2003). *Research methods and organization studies*. Routledge.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates

Cosmas, J. K. (2018). Perceived challenges and recommendations for overcoming challenges by diploma in adult education student, teachers through open and distance learning in Tanzania: A case of institute of adult education, Dodoma centre, Tanzania. International Journal of Innovative Research and Development, 7(10), 1-8.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approach* (5th ed.). SAGE Publications.

Drakidou, C. (2018). Micro-learning as an Alternative in Lifelong eLearning. The Aristotle University of Thessaloniki.

Elhamuye, M. (2024). Evaluating the Effectiveness of Blended Learning Approaches in ESL/EFL Education. Innovation in Language Learning and Teaching.

ElSayad, G. (2024). Higher education students' learning perception in the blended learning community of inquiry. Journal of Computers in Education, 11(4), 1061-1088. https://doi.org/10.1007/s40692-023-00290-y

Ghasia, M. A., & Rutatola, E. P. (2021). Contextualizing micro-learning deployment: An evaluation report of platforms for the higher education institutions in Tanzania. *International Journal of Education and Development using Information and Communication Technology*, *17*(1), 65-81.

Emmanuel, O. (2018). Realization of time as a resource in the practice of Adult Education: The case of COBET programme in Dar es Salaam Region. *Journal of Adult Education in Tanzania*, *21*(1).

Fitria, T. N. (2022). Microlearning in teaching and learning process: A review. CENDEKIA: Jurnal Ilmu Sosial, Bahasa Dan Pendidikan, 2(4), 114-135. https://doi.org/10.55606/cendikia.v2i4.473

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. The Internet and Higher Education, 10(3), 157-172.

Garrison, D. R., & Vaughan, N. D. (2008). Blended learning in higher education: Framework, principles, and guidelines. Jossey-Bass.

Ghasia, M. A., & Rutatola, E. P. (2021). Contextualizing micro-learning deployment: An evaluation report of platforms for the higher education institutions in Tanzania. International Journal of Education and Development using Information and Communication Technology, 17(1), 65-81.

Gürbüz, S. (2017). Survey as a quantitative research method. *Research methods and techniques in public relations and advertising*, *2017*, 141-62.

Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk & C. R. Graham (Eds.), Handbook of blended learning (pp. 3–21). Pfeiffer.

Hoic-Bozic, N., Mornar, V., & Boticki, I. (2008). A blended learning approach to course design and implementation. IEEE transactions on education, 52(1), 19-30. https://doi.org/10.1109/TE.2007.914945

Hrastinski, S. (2019). What do we mean by blended learning? TechTrends, 63, 564–569. https://doi.org/10.1007/s11528-019-00375-5

Jeffrey, L. M., Milne, J., Suddaby. G., & Higgins, A. (2014). Blended learning: How teachers balance the blend of online and classroom components. Journal of Information Technology Education: Research, 13, 121-140. http://www.jite.org/documents/Vol13/JITEv13ResearchP121-140Jeffrey0460.pdf

Johnson, J. W., & LeBreton, J. M. (2004). History and use of relative importance indices in organizational research. *Organizational research methods*, *7*(3), 238-257.DOI: 10.1177/1094428104266510

Kaur, M. (2013). Blended learning-its challenges and future. Procedia-social and behavioral sciences, 93, 612-617. https://doi.org/10.1016/j.sbspro.2013.09.248

Kaplan, A. (2016). Lifelong learning: conclusions from a literature review. International Online Journal of Primary Education, 5(2), 43-50.

Kapinga, B., & Mtani, M. (2014). Challenges faced by adult learners enrolled in blended distance learning programmes: A case study of the institute of adult education. *Huria: journal of the open university of Tanzania*, *18*(1), 100-106. https://doi.org/10.61538/huria.v18i0.13

Kometa, S. T., Olomolaiye, P. O., & Harris, F. C. (1994). Attributes of UK construction clients influencing project consultants' performance. *Construction Management and Economics, 12*(5), 433–443. https://doi.org/10.1080/0144619940000005

Kyei-Blankson, L., Ntuli, E., & Donnelly, H. (2019). Establishing the importance of interaction and presence to student learning in online environments. Journal of Interactive Learning Research, 30(4), 539-560.

Lusa, H., Adnan, A., & Yurniawati, Y. (2022). Effect of blended learning on students' learning outcomes: A meta-analysis. Jurnal Pendidikan Progresif, 12(2), 309-325.

Mahai, L. S. (2021). Adult Education Centre Learning in Tanzania: Motives, Challenges and Interventions. SCHOOL OF EDUCATION, 36.

Mariki, B. E. (2025). Contextual Challenges and Adaptive Strategies of ODL Learners at the Institute of Adult Education, Tanzania. *Journal of Adult Education in Tanzania*, *27*(1).

Martin, F., Wu, T., Wan, L., & Xie, K. (2022). A meta-analysis on the community of inquiry presences and learning outcomes in online and blended learning environments. Online Learning, 26(1), 325-359. https://doi.org/10.24059/olj.v26i1.2604

McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., ... & Mumper, R. J. (2014). The flipped classroom: a course redesign to foster learning and engagement in a health professions school. Academic medicine, 89(2), 236-243.

Means, B., Toyama, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers college record*, *115*(3), 1-47. https://doi.org/10.1177/016146811311500

Msuya, A. A. (2016). Facilitators and learners' perceptions on the implementation of competence-based curricula in adult education programmes in Tanzania (Doctoral dissertation, The Open University of Tanzania).

Mwakyambiki, S. E., Lunyelele, S. P., Ndumbaro, R., & Ndunguru, W. (2024). Assessing Adults' Willingness to Engage in Adult Education: A Case Study of Kigamboni and Temeke Municipalities. Tanzania. Journal of Adult Education in Tanzania, 26(1), 65-85.

Mwila, C. A. (2025). An Investigation into the Challenges Faced by ODL Students in Iringa, Tanzania. *Journal of Adult Education in Tanzania*, *27*(2).

Mostrady, A., Sanchez-Lopez, E., & Gonzalez-Sanchez, A. F. (2025). Microlearning and its effectiveness in modern education: A mini review. Acta Pedagogia Asiana, 4(1), 33-42.

Năznean, A. (2022). Effective teacher-learner communication and interaction–a brief literature. Journal pedagogy, 1, 151-161.

Nikkhoo, I., Ahmadi, Z., Akbari, M., Imannezhad, S., Anvari Ardekani, S., & Lashgari, H. (2023). Microlearning for today's students: A rapid review of essentials and considerations. Medical Education Bulletin, 4(1), 673-685. https://doi.org/10.22034/meb.2022.355659.1066

Picciano, A. G. (2009). Blending with purpose: The multimodal model. *Journal of asynchronous learning networks*, *13*(1), 7-18.

Pitaloka, N. (2025). The Impact of Video-Based Microlearning on Student Learning Outcomes and Motivation. *Journal of Education Innovation and Curriculum Development*, *3*(2), 72–79. Retrieved from https://journals.iarn.or.id/index.php/educur/article/view/534

Nikou, S. (2019, March). A micro-learning-based model to enhance student teachers' motivation and engagement in blended learning. In Society for Information Technology & Teacher Education International Conference (pp. 509-514). Association for the Advancement of Computing in Education (AACE).

Nikou, S. (2019, March). A micro-learning-based model to enhance student teachers' motivation and engagement in blended learning. In Society for Information Technology & Teacher Education International Conference (pp. 509-514). Association for the Advancement of Computing in Education (AACE).

Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. Computers & education, 144, 103701.

Ryan, R. M., & Deci, E. L. (2024). Self-determination theory. In Encyclopedia of quality of life and well-being research (pp. 6229-6235). Cham: Springer International Publishing.

Sakhare, M. V., & Chougule, M. B. (2019). Construction equipment monitoring: By using relative important indices (Rii) analysis. Int. Res. J. Eng. Technol. (IRJET), 6, 261-263.

Semingson, P., Crosslin, M., & Dellinger, J. (2015, March). Microlearning as a tool to engage students in online and blended learning. In Society for Information Technology & Teacher Education International Conference (pp. 474-479). Association for the Advancement of Computing in Education (AACE).

Senadheera, V. V., Muthukumarana, C. K., Ediriweera, D. S., & Rupasinghe, T. P. (2023). Impact of microlearning on academic performance of students in higher education: A systematic review and meta-analysis.

Senandheera, V. V., Muthukumarana, C. K., Ediriweera, D. S., & Rupasinghe, T. P. (2024). Impact of microlearning on academic performance of students in higher education: A systematic review and meta-analysis. *Journal of Multidisciplinary & Translational Research*, *9*(1).

Sozmen, E. Y. (2022). Perspective on pros and cons of microlearning in health education. Essays in Biochemistry, 66(1), 39-44.

Taylor, A. D., & Hung, W. (2022). The effects of microlearning: A scoping review. *Educational technology research and development*, *70*(2), 363-395.

Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. Heliyon, 8(12). https://doi.org/10.1016/j.heliyon.2022.e12657

Topping, K. J. (2023). Advantages and disadvantages of online and face-to-face peer learning in higher education: A review. Education Sciences, 13(4), 326.

Vaughan, N. D. (2010). A blended community of inquiry approach: Linking student engagement and course redesign. The Internet and Higher Education, 13(1-2), 60-65.

Vallée, A., Blacher, J., Cariou, A., & Sorbets, E. (2020). Blended learning compared to traditional learning in medical education: systematic review and meta-analysis. Journal of medical Internet research, 22(8), e16504. https://doi.org/10.2196/16504

Vo, H. M., Zhu, C., & Diep, N. A. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. Studies in Educational Evaluation, 53, 17-28.

Yin, B., & Yuan, C. H. (2024). Blended learning performance influence mechanism based on community of inquiry. Asia Pacific Journal of Education, 44(4), 977-992.

Yu, Q., Yu, K., Li, B., & Wang, Q. (2025). Effectiveness of blended learning on students' learning performance: a meta-analysis. Journal of research on Technology in educaTion, 57(3), 499-520. https://doi.org/10.1080/15391523.2023.2264984

Zarshenas, L., Mehrabi, M., Karamdar, L., Keshavarzi, M. H., & Keshtkaran, Z. (2022). The effect of micro-learning on learning and self-efficacy of nursing students: an interventional study. BMC Medical Education, 22(1), 664. https://doi.org/10.1186/s12909-022-03726-8

Zhang, H. Huang, R., & Ma, D (2008). Towards a design theory of blended learning curriculum. Hybrid Learning and Education. LectureNotes in Computer Science, 5169, 66, 78